

WHAT IS CLAIMED IS:

1. A composition comprising a polypeptide and a CpG molecule, wherein said polypeptide comprises a cytotoxic T lymphocyte-activating amino acid sequence and a CpG-interacting amino acid sequence, wherein said cytotoxic T lymphocyte-activating amino acid sequence is heterologous to said CpG-interacting amino acid sequence, wherein said CpG-interacting amino acid sequence comprises at least one cysteine residue, and wherein said CpG molecule comprises at least one sulfur atom.
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- 10 2. The composition of claim 1, wherein said CpG-interacting amino acid sequence further comprises at least one positively charged amino acid.
- 15 3. The composition of claim 1, wherein said CpG-interacting amino acid sequence comprises no more than 15 amino acid residues.
4. The composition of claim 1, wherein said CpG-interacting amino acid sequence comprises no more than 10 amino acid residues.
- 20 5. The composition of claim 1, wherein said CpG-interacting amino acid sequence consists essentially of 6 amino acid residues.
6. The composition of claim 1, wherein said CpG-interacting amino acid sequence comprises a B-X, X-B, or B-X-B sequence, wherein B is a positively charged amino acid residue and X is an amino acid residue.
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7. The composition of claim 1, wherein said CpG-interacting amino acid sequence comprises an B-X-B-X-B sequence, wherein B is a positively charged amino acid residue and X is an amino acid residue.
- 30 8. The composition of claim 1, wherein said CpG-interacting amino acid sequence comprises at least two cysteine residues.

9. The composition of claim 1, wherein said CpG-interacting amino acid sequence comprises at least 4 positively charged amino acid residues.

5 10. The composition of claim 1, wherein at least one of said at least one cysteine residue of said CpG-interacting amino acid sequence is adjacent to a positively charged amino acid residue.

10 11. The composition of claim 10, wherein said CpG-interacting amino acid sequence comprises the sequence set forth in SEQ ID NO:1 (KCSRNR).

12. The composition of claim 1, wherein said CpG-interacting amino acid sequence consists essentially of the sequence set forth in SEQ ID NO:1 (KCSRNR).

15 13. The composition of claim 1, wherein said CpG-interacting amino acid sequence consists essentially of the sequence set forth in SEQ ID NO:2 (ACSAN).

14. The composition of claim 13, wherein said at least one positively charged amino acid residue is an arginine.

20 15. The composition of claim 13, wherein said at least one positively charged amino acid residue is a lysine.

25 16. The composition of claim 1, wherein said cytotoxic T lymphocyte-activating amino acid sequence comprises no more than 50 amino acid residues.

17. The composition of claim 1, wherein said cytotoxic T lymphocyte-activating amino acid sequence comprises no more than 25 amino acid residues.

30 18. The composition of claim 1, wherein said cytotoxic T lymphocyte-activating amino acid sequence comprises no more than 20 amino acid residues.

19. The composition of claim 1, wherein said cytotoxic T lymphocyte-activating amino acid sequence comprises no more than 10 amino acid residues.

5 20. The composition of claim 1, wherein said polypeptide is less than 50 amino acid residues in length.

21. The composition of claim 1, wherein said polypeptide is less than 40 amino acid residues in length.

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22. The composition of claim 1, wherein said polypeptide is less than 30 amino acid residues in length.

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23. The composition of claim 1, wherein said polypeptide is less than 20 amino acid residues in length.

24. The composition of claim 1, wherein said CpG molecule comprises a phosphorothioate linkage.

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25. The composition of claim 1, wherein said CpG molecule comprises a phosphorothioate backbone.

26. A method for producing a composition having enhanced immunogenicity, said method comprising:

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(a) obtaining a polypeptide having a cytotoxic T lymphocyte-activating amino acid sequence and a CpG-interacting amino acid sequence, wherein said cytotoxic T lymphocyte-activating amino acid sequence is heterologous to said CpG-interacting amino acid sequence, and wherein said CpG-interacting amino acid sequence comprises at least one cysteine residue; and

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(b) contacting said polypeptide to a CpG molecule comprising a sulfur atom to form said composition.

27. The method of claim 26, wherein said CpG-interacting amino acid sequence further comprises at least one positively charged amino acid.

5 28. A solution comprising a precipitate, wherein said precipitate comprises a polypeptide and a CpG molecule, wherein said polypeptide comprises a cytotoxic T lymphocyte-activating amino acid sequence and a CpG-interacting amino acid sequence, wherein said cytotoxic T lymphocyte-activating amino acid sequence is heterologous to said CpG-interacting amino acid sequence, wherein said CpG-interacting amino acid sequence comprises at least one cysteine residue and at least one positively charged amino acid residue, and wherein said CpG molecule comprises a sulfur atom.

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29. The solution of claim 28, wherein said solution is aqueous.

15 30. A method for making a solution comprising a precipitate, said method comprising:

20 (a) obtaining a polypeptide having a cytotoxic T lymphocyte-activating amino acid sequence and a CpG-interacting amino acid sequence, wherein said cytotoxic T lymphocyte-activating amino acid sequence is heterologous to said CpG-interacting amino acid sequence, and wherein said CpG-interacting amino acid sequence comprises at least one cysteine residue and at least one positively charged amino acid residue; and

25 (b) contacting said polypeptide to a CpG molecule comprising a sulfur atom, wherein said contacting is performed in solution and under conditions wherein said polypeptide and said CpG molecule form a precipitate, thereby forming said solution comprising a precipitate.

31. A method for activating a cytotoxic T lymphocyte within a mammal, said method comprising administering a composition comprising a polypeptide and a CpG molecule to said mammal, wherein said polypeptide comprises a cytotoxic T lymphocyte-activating amino acid sequence and a CpG-interacting amino acid sequence, wherein said cytotoxic T lymphocyte-activating amino acid sequence is heterologous to said CpG-interacting amino

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acid sequence, wherein said CpG-interacting amino acid sequence comprises at least one cysteine residue, and wherein said CpG molecule comprises a sulfur atom.

32. The method of claim 31, wherein said CpG-interacting amino acid sequence
5 further comprises at least one positively charged amino acid.

33. A method of identifying a polypeptide that activates cytotoxic T lymphocytes, said method comprising:

10 (a) combining a test polypeptide with a CpG molecule to form a mixture;
(b) administering said mixture to a mammal;
(c) harvesting cytotoxic T lymphocytes from said mammal; and
15 (d) determining whether or not the level of CD8⁺ cytotoxic T lymphocytes in said mammal is increased compared to the level of CD8⁺ cytotoxic T lymphocytes in said mammal before step (b), wherein an increase indicates that said test polypeptide is said polypeptide that activates cytotoxic T lymphocytes.

34. The method of claim 33, wherein said cytotoxic T lymphocytes are harvested from the spleen of said mammal.

20 35. The method of claim 33, wherein said mammal is a mouse.

36. A method of identifying a CpG-interacting amino acid sequence, said method comprising:

25 (a) contacting a test amino acid sequence with a CpG molecule, wherein said contacting is performed in solution, and
(b) determining whether or not said test amino acid sequence and said CpG molecule form a precipitate, wherein the formation of a precipitate indicates that said test amino acid sequence is said CpG-interacting amino acid sequence.

30 37. A method of identifying a CpG-interacting amino acid sequence, said method comprising:

(a) administering a polypeptide/CpG molecule mixture to a mammal, wherein said polypeptide comprises a cytotoxic T lymphocyte-activating amino acid sequence and a test amino acid sequence, and

5 (b) determining whether or not said mixture activates cytotoxic T lymphocyte from said mammal to a level greater than the level of activation that occurs in a control mammal that received a control polypeptide/CpG molecule mixture, wherein the polypeptide of said control polypeptide/CpG molecule mixture lacks said test amino acid sequence, and wherein said greater level of cytotoxic T lymphocyte activation indicates that said test amino acid sequence is said CpG-interacting amino acid sequence.